REVIEW OF *ANOPLOLEPIS* WITH REFERENCE TO MALE GENITALIA, AND NOTES ON *ACROPYGA* (HYMENOPTERA, FORMICIDAE)

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(With 16 figures)

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ABSTRACT

Pugnacious ants are abundant in orchards and vineyards, are predacious and, together with species of *Acropyga* Roger, tend hemipterons. Only two species of pugnacious ants, *Anoplolepis custodiens* (Smith) and *A. steingroeveri* (Forel), and one species of *Acropyga* are present in South Africa. Male genitalia are employed in this short review to separate the species. South African species of *Acropyga* have four to five segmented maxillary palpi. *Anoplolepis braunsi* (Forel) is a synonym of *A. steingroeveri* (Forel), and *Acropyga rhodesiana* Santschi a synonym of *A. arnoldi* Santschi.

CONTENTS

INTRODUCTION

Pugnacious ants are well known for their aggressiveness and fast zig-zag movements on the ground when disturbed. During the early summer and autumn labourers in orchards and vineyards are often so molested that they are forced to stop their work. Fortunately these ants seldom enter houses.

As in the case of the Argentine and brown house-ant, the pugnacious ants and ants of the genus *Acropyga* are fond of honeydew, which forms an important part of their diet. They therefore tend aphids, coccids and their kin

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for the sake of the honeydew produced by these insects. The ants soliciting these hemipterons are not always as innocent as they appear to be, as some of the trophobionts have to be sacrificed under adverse conditions to provide for the protein demands of their guardians. Apparently the ants are merely cheated by their trophobionts, which are mistaken for donor ants (Kloft 1959; Wilson 1971).

The activities of the pugnacious ants are largely influenced by temperature and relative humidity (Steyn 1954) and they will even visit trees during the winter months to collect honeydew when the days are warm. The medium or larger workers store the honeydew in their crops and during cooler weather this is then apparently metabolized to fat (Smit 1964). However, it was found that in certain species of ants the honeydew received from foraging workers is stored by the repletes during cooler conditions. As soon as the temperature increases, resulting in a higher rate of metabolism, the direction of the flow is reversed (Wilson 1971). Honeypot ants with extreme forms of repletes are therefore usually found in arid or semi-arid regions. In orchards and vineyards where honeydew is fairly easily obtained, it was observed that there are many more minors and medium-type workers present in a nest than in nests found in the veld where other food sources have to be utilized.

In the feeding process of the ants the natural enemies of the trophobionts are disturbed to such an extent that predation and parasitism are obstructed. In citrus orchards in particular, populations of pugnacious ants feeding on honeydew from aphids and soft scales usually result in coincident red scale *Aonidiella aurantii* (Maskell), infestations, directly as a result of the influence of the ants on the natural enemies.

We are, however, inclined to look only at the injurious effects of the ants, whereas they also play an important part in the destruction of noxious insects, and problems often arise when the natural balance between existing species is upset. Steyn (1954) lists a whole series of arthropods which form part of the diet of the common pugnacious ant, and which include the harvester termite, *Hodotermes mossambicus*, cockchafers, false codling-moth, and bollworms. These ants also play an important role as pollinators of flowers. In recent surveys in fynbos in the southern Cape, for instance, the black pugnacious ant *A. steingroeveri*, was found in very large numbers on *Protea compacta*.

According to their behavioural pattern, the pugnacious ants (and probably also *Acropyga*) are unicolonial, although in a few cases observed in northern Transvaal a whole series of small colonies was found in a rather limited area; disturbance of these colonies, however, resulted in fierce fighting. Steyn (1954) and Louw (1968) discuss the biology and ecology of the common pugnacious ant and information on the other species is given by Myers (1957) and Prins *et al.* (1979).

The following abbreviations have been used in the text (for further reference see Prins (1973)). The nomenclature of the wing venation is according to Wheeler (1960).

Ia		—cells of front and hind wings
m	—(median)	
w	—(first cubital)	
CI	—cephalic index (head width/HL × 100)	
CL	—clypeus length	
CLI	—clypeal index (clypeal width/CL × 100)	
cub	—(cubital)	—veins of front and hind wings
d	—(discoidal)	
e	—(exteromedian)	
m + cua		
r	—(marginal or radial)	
tr	—(transversomedian)	
cu	—cuspis	
di	—digitus	
ED	—distance between compound eyes	
HFI	—hind femur index (HFL/WL × 100)	
HFL	—hind femur length	
HL	—head length	
L	—length from anterior margin of clypeus to base of abdomen	
lab	—labrum	
MFL	—middle femur length	
p	—penis lobes	
PI	—petiolar index (petiolar width/PL × 100)	
SI	—scape index (SL/head width × 100)	
SL	—scape length	
st	—gonostipes	
TI	—thoracic index (thoracic width/WL × 100)	
TL	—total length of body	
v	—volsella	
WL	—length of truncus	

Genus *Anoplolepis* Santschi

Arnold (1922) includes the three species of pugnacious ants viz., *Anoplolepis custodiens*, *A. steingroeveri*, and *A. braunsi* in the subgenus *Zealleyella* on account of their very convex epinotum. The two species *A. braunsi* and *steingroeveri* are distinguished only by the thickness of the scale of the petiole, the distinctness of the mesometanotal suture, and the shape of the sides of the head. To date no alates of *braunsi* have been collected, only workers, which in all respects agree with the workers of *A. steingroeveri*. *A. braunsi* therefore appears to be a junior subjective synonym of *A. steingroeveri*; Forel described the latter species in 1894 and the former in 1913.

There is also a fourth species, viz. *A. nuptialis*, which is known only from its alates, and which lives as an inquinilist in the nests of the common pugnacious ant. Both males and females were observed, but workers are unknown, and they are therefore probably truly inquilinous. It appears that the alates of this species enter the nests (mating may occur in or near the nest) and are then accepted by the workers of the common pugnacious ant, which later destroy the host alates. Only one case is known where they penetrated the nest of the black pugnacious ant.

Anoplolepis custodiens (Smith, 1858), common pugnacious ant

Worker (Figs 1A–B, 2A–D)

TL 3–10 mm; L 2,0–5,0 mm; HL 0,76–2,2 mm; ED 0,48–1,64 mm; CL 0,24–0,80 mm; SL 0,96–2,44 mm; WL 1,08–3,30 mm; MFL 0,80–2,56 mm; HFL 1,02–3,0 mm; PL 0,16–0,40 mm; CI 94,7–104,5; SI 133,3–106,1; CLI 200,0; CTI 70,4–66,7; TI 44,4–44,8; PI 125,0–190; HFI 94,4–90,9.

Polymorphic, colour yellowish-brown to reddish-brown or even somewhat darker with abdomen dark-brown to almost blackish-brown, therefore easily confused with workers of the black pugnacious ant. Separated from latter species by chequered pattern on abdomen, caused by reflection of light on pubescent hairs, which are arranged in two different directions on each side. Few pilose hairs also present, particularly on head, apical borders of abdominal segments and on femora.

Anterior border of cypeus angular in the middle, acutely so in some specimens; in lateral view less convex than in black pugnacious ant. Scale of petiole rather flattened in larger workers and fairly deeply emarginate above; scale narrowed dorsally in minors and emargination generally almost obsolete.

The chequered pattern on abdomen and form of the clypeus are not as distinct as in the majors or media and this caste is therefore difficult to identify in the absence of larger workers. The convex epinotum is characteristic of the workers of the subgenus *Zealleyella*, and seen from the side it is almost as high as the promesonotum in the majors; in the minors it may be much higher.

Female (Fig. 3A–B)

Wing-span about 27,4 mm; TL 13,3–15,8 mm; L 6,5–7,3 mm; HL 2,2 mm; ED 1,9 mm; CL 0,7 mm; SL 2,3 mm; WL 4,5–5,2 mm; MFL 2,4–2,6 mm; HFL 2,8–2,9 mm; PL 0,44–0,48 mm; CI 113,6; SI 92,0; CLI 242,8–257,2; CTI 48,9–42,3; TI 68,9–67,3; PI 216,7–241,7; HFI 62,2–55,6.

It has the general features of the females of the subfamily Formicinae, with a distinct chequered pattern on the abdomen and a wide and fairly deep emargination on the dorsal edge of the scale of the petiole. Colour more or less as in the worker, the wings ochreous-yellow with darker subcostal cell; the abdomen sometimes much darker. Clypeus also angular in the middle as in the case of the workers.

Wing venation as in Figures 3A, 4A, and although there are minor variations in the venation of the same individual, the vein m + cua of the hind wing much shorter than the preceding cell Ia; in the specimens examined, this vein is shorter than half the length of the cell.

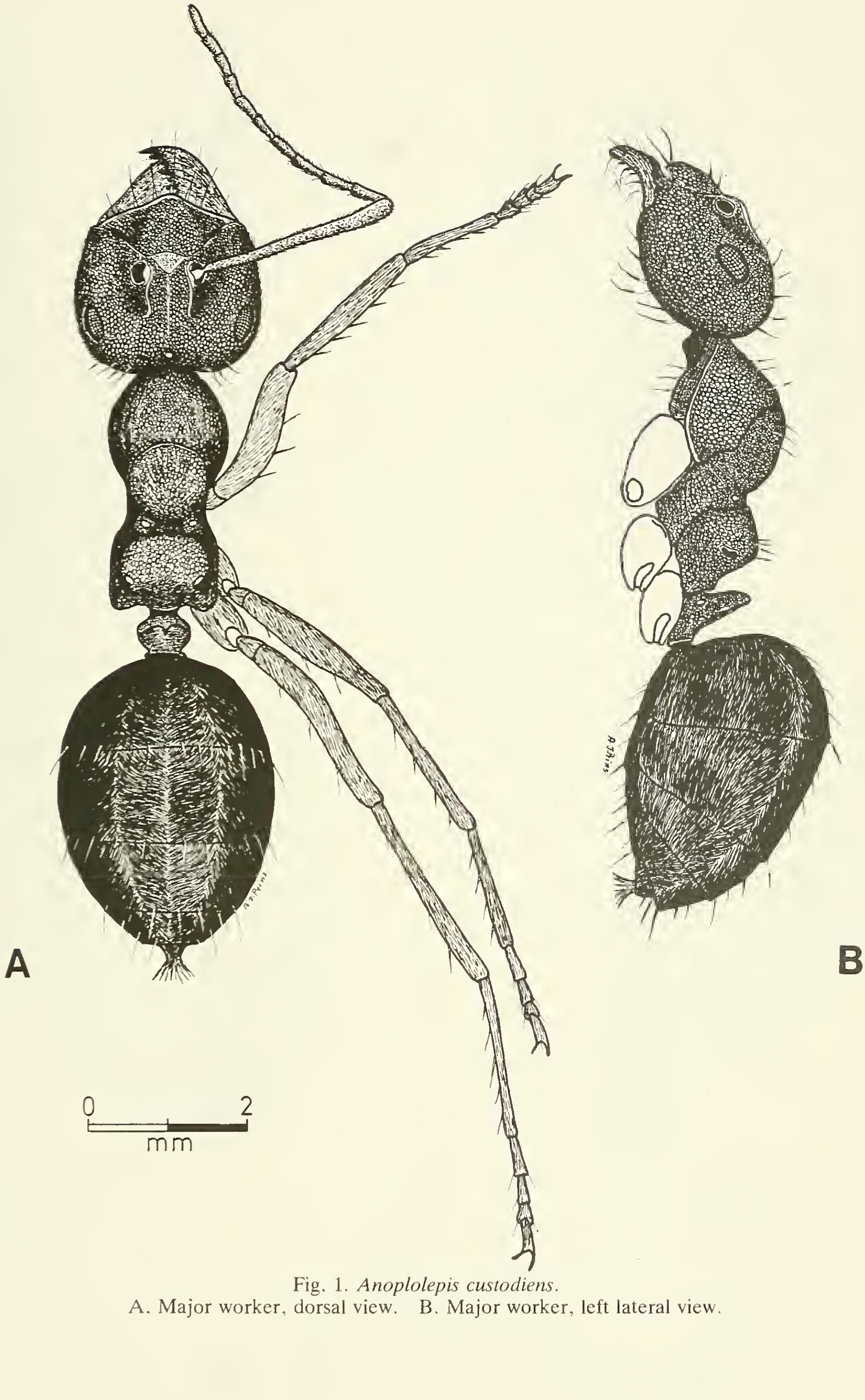


Fig. 1. *Anoplolepis custodiens*.
A. Major worker, dorsal view. B. Major worker, left lateral view.

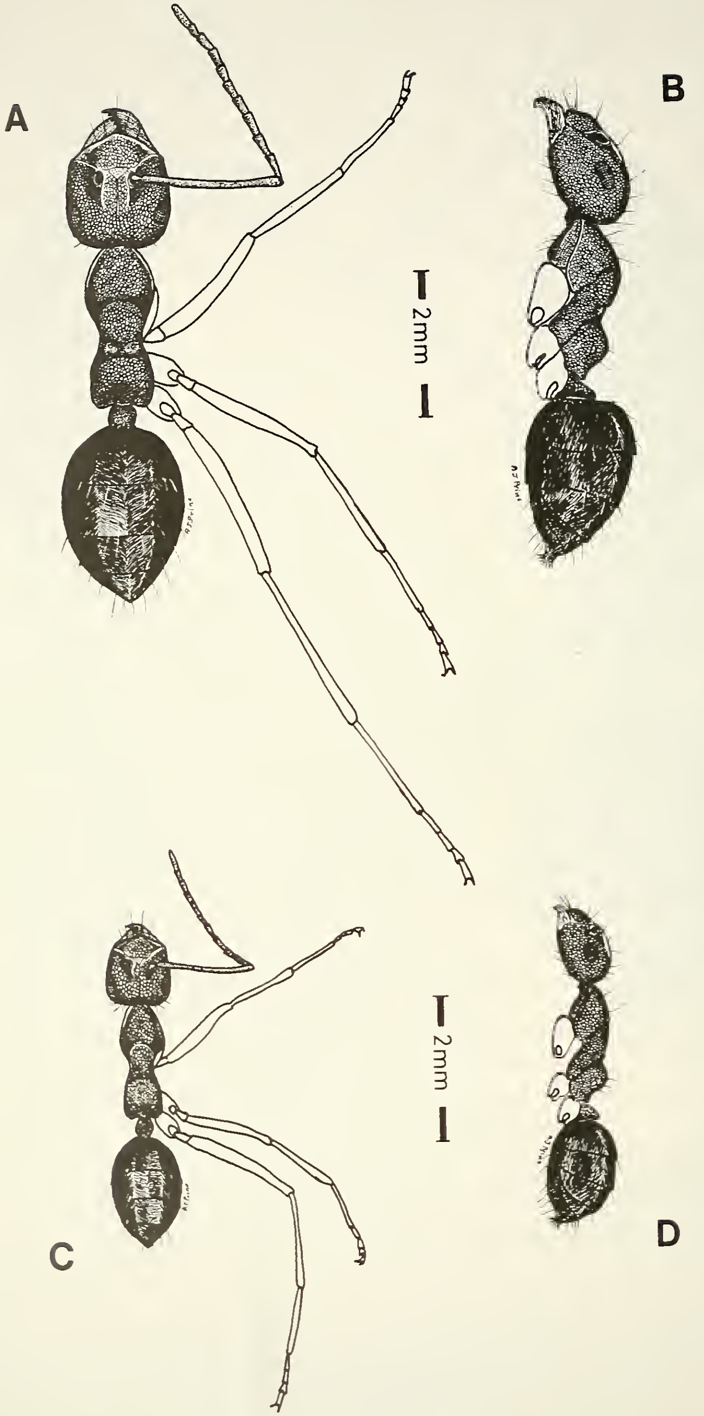


Fig. 2. *Anoplolepis custodiens.*
A. Median worker, dorsal view. B. Median worker, left lateral view.
C. Minor worker, dorsal view. D. Minor worker, left lateral view.

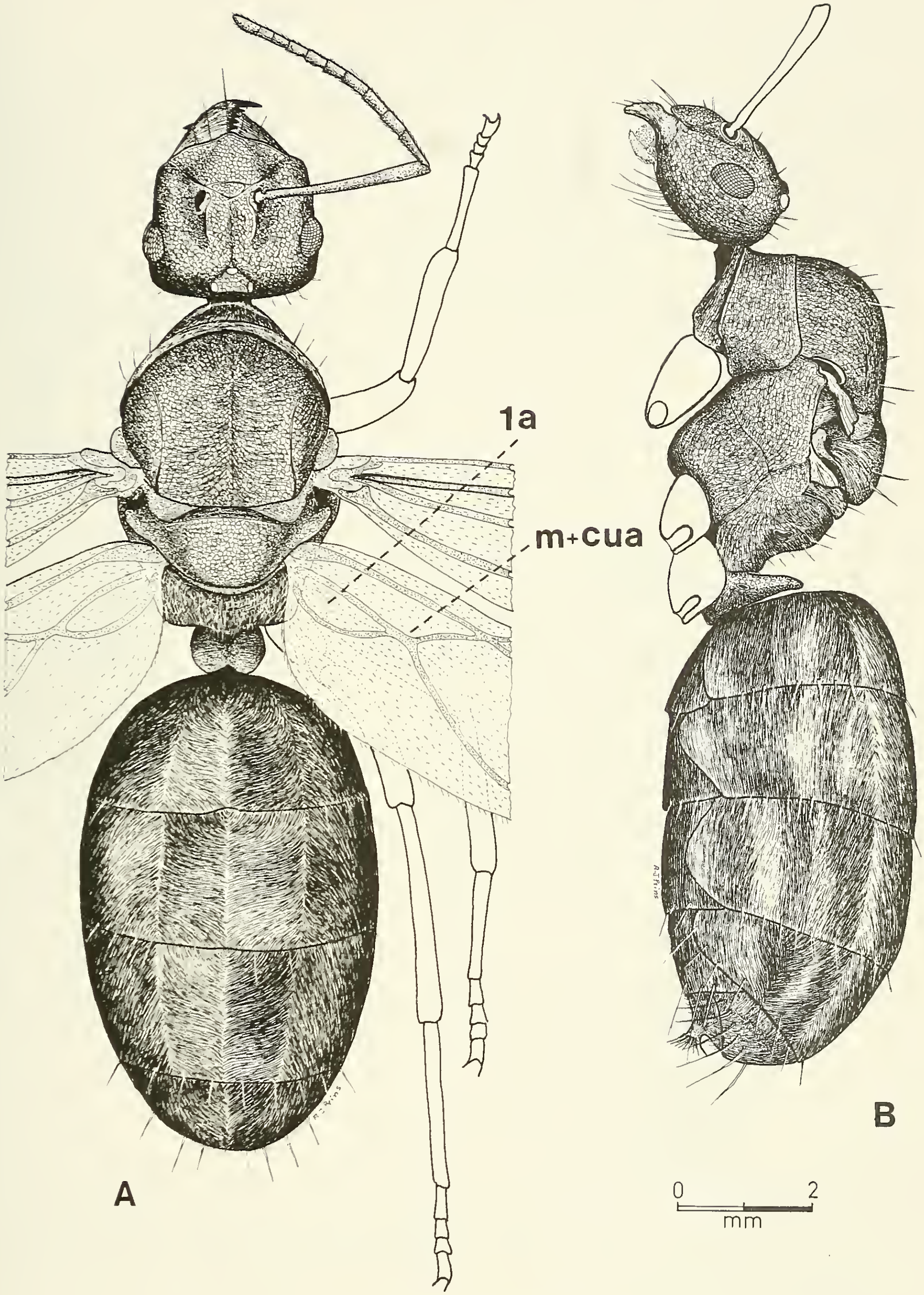


Fig. 3. *Anoplolepis custodiens*.
A. Female, dorsal view. B. Female, left lateral view.

Male (Figs 4A–C, 9A–B, 10D–F, 11C–D)

Wing-span about 19,0 mm; TL 9,9–10,8 mm; L 3,6–3,7 mm; HL 1,6–1,64 mm; ED 1,2 mm; CL 0,44–0,48 mm; SL 2,2 mm; WL 3,5–3,8 mm; MFL 2,5–2,7 mm; HFL 2,8–3,0 mm; PL 0,4 mm; CI 112,5–109,8; SI 12,2; CLI 254,5–233,3; CTI 45,7–40,3; TI 57,9–62,9; PI 190–200; HFI 80,0–78,9.

Slightly smaller than the female and, as in the case of the latter, they resemble the males of the subfamily Formicinae. Indistinct chequered pattern present on the abdomen, although the direction in which the pubescent hairs are arranged is fairly clearly indicated. Generally darker in colour than female, more slender, and the clypeus also angular in the middle. Scale of petiole with indistinct emargination on dorsal edge. Labrum as in Figure 9A.

Although the vein m + cua of the hind wing (Fig. 3A) is much longer in most specimens seen, it is not longer than half the length of cell Ia.

External male reproductive organs

The last complete visible segment in the abdomen of the male is the sixth (the true eighth), the seventh (true ninth) being reduced to a ring-like sclerite (also known as gonocardo or lamina annularis), which is membraneous dorsally, but on the ventral side it is flattened, plate-like and sclerotized. In *A. custodiens* the flattened plate is fairly deeply and angularly emarginate behind. The two lobes formed by the emargination are thinner than the rest of the plate and are ventrally covered with fine hairs. The plate itself is about twice as wide as long. Penis or aedeagus situated medially and characterized by its two lobes; it is somewhat shorter than external lobes, which cover reproductive organs and are also known as gonostipes (gonoforceps or parameres). In lateral view the apices of gonostipes are round and broad. On each side and somewhat below penis is a globular volsella with an outer appendage or cuspis and an inner shorter digitus. Both digiti and cuspides are devoid of denticles, except in case of some individuals where there are a few tubercles, particularly on apices of cuspides. Each volsella has some fine hairs on ventral side.

Material examined

3 ♀♀ Bulawayo, June 1912, G. Arnold; 4 ♀♀ Ellis pass, 2.4.69, A. Barnard; 3 ♂♂ Bulawayo, 30.1.1912, G. Arnold; 4 ♂♂ Ellis pass, 2.4.69, A. Barnard; 9 ☿☿ Matopos, 5.11.44, G. Arnold; 12 ☿☿, Du Toitskloof Pass, 29.5.74, A. J. Prins; 7 ☿☿ Ellis pass, 2.4.69, A. Barnard.

Anoplolepis nuptialis (Santschi, 1916)

Female

Wing-span about 25,2 mm; TL 11,6–13,6 mm; L 4,9–5,1 mm; HL 1,8–1,9 mm; ED 1,6–1,7 mm; CL 0,44–0,48 mm; SL 1,6–1,9 mm; WL 3,6–3,7 mm; MFL 1,9 mm; HFL 2,4–2,3 mm; PL 0,36–0,4 mm; CI 115,6–115,8; SI 76,9–86,4; CLI 291,7–318,2; CTI 50,0–51,4; TI 63,9–64,9; PI 150,0–260,0; HFI 63,9–64,9.

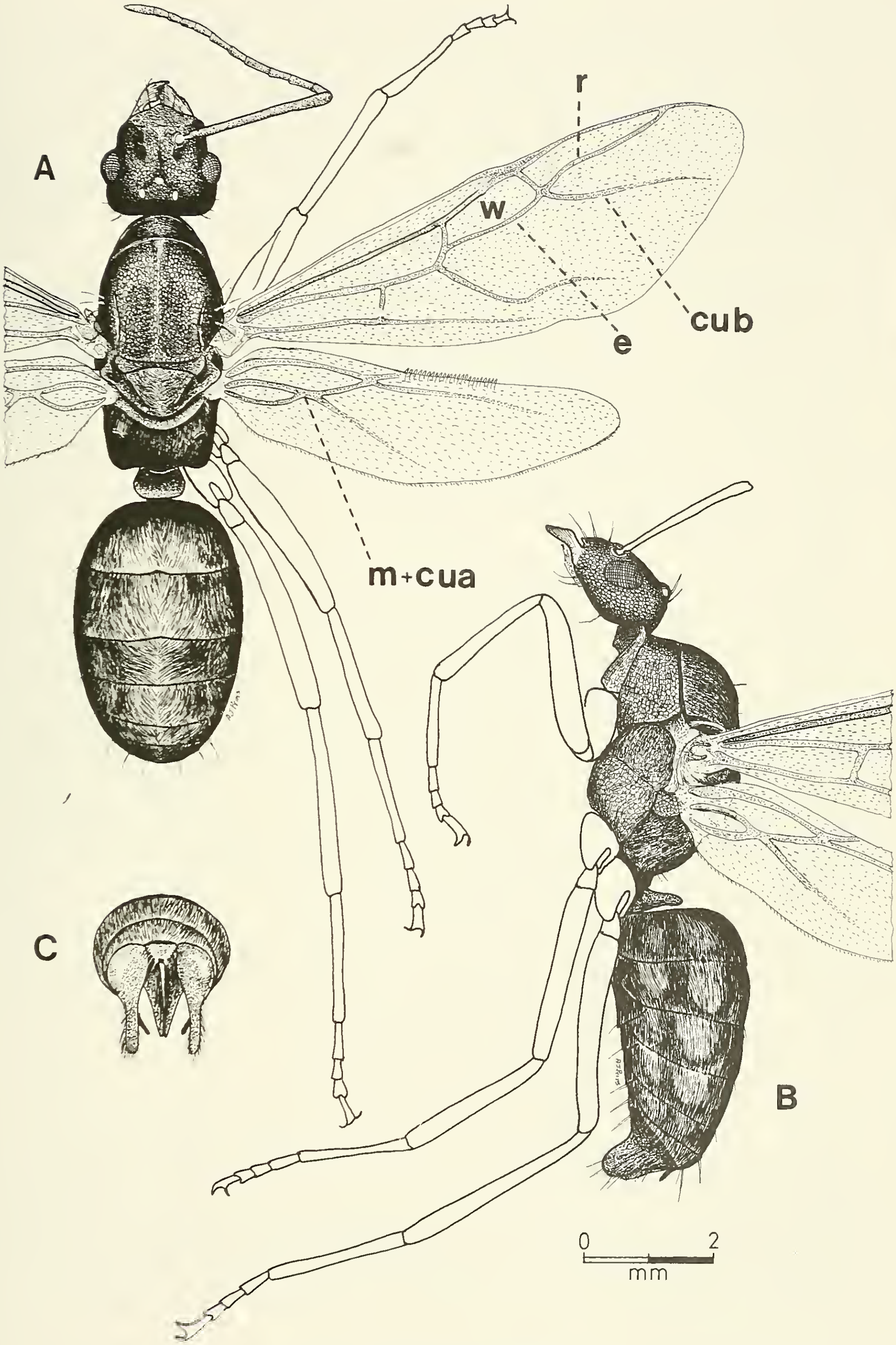


Fig. 4. *Anoplolepis custodiens*.
A. Male, dorsal view. B. Male, left lateral view. C. Male genitalia, seen from the rear.

As a previous description of the female could not be traced, it is described here in more detail than in the case of the other species. Very similar to female of *A. custodiens*, but lighter in colour, generally yellowish-brown to brownish-yellow, including the legs and abdomen. Chequered pattern on abdomen rather inconspicuous, although direction in which the pubescent hairs are arranged, is fairly distinct. Whole body including legs and antennae covered with an almost silvery pubescence, hairs on the antennae shorter than on body and legs. A few pilose hairs present, particularly on the head, posterior borders of abdominal segments, and on femora.

Head somewhat wider than long, slightly narrower in front than behind, the sides almost straight. Clypeus angular in middle, however, the angle not as acute as in *A. custodiens*. Scape of the eleven-segmented antennae extending behind hind margin of head by less than half its length. Compound eyes large, about one-quarter the length of the head and situated far back, on the posterior half as in other species. Ocelli large, larger in relation to size of head than in *A. custodiens*. Frontal carinae short, ending at about middle of compound eyes. Mandibles as in *custodiens*, with eight to nine sharp teeth, the apical ones long and pointed.

Truncus more or less as in *A. custodiens*, somewhat wider than head, scale of petiole varied, usually wider above than below, when seen from the rear; emargination of dorsal edge varying from obsolete to deep and U-shaped. In some specimens it is even widely emarginate on each side, thus appearing bilobed on either side of median emargination (Fig. 5D). Wings more or less as in latter species, but vein m + cua of hind wing long, usually as long as half the length of cell Ia or even longer. In most specimens seen the exteromedian vein of front wings, below stigma, more sinuous than in *A. custodiens* or *A. steingroeveri*, and with a thickening in about the third of its length from the median cell (also present in some males—Fig. 5A). Abdomen only slightly wider than truncus and therefore smaller than in *A. custodiens*.

Male (Figs 5A–C, 9C–D, 10A–C, 11E–F)

Wing-span about 19,9 mm; TL 9,1–11,5 mm; L 3,9–4,3 mm; HL 1,4 mm; ED 1,1–1,2 mm; CL 0,4 mm; SL 1,9 mm; WL 3,0–3,2 mm; MFL 1,8–2,0 mm; HFL 2,1–2,5 mm; PL 0,3–0,4 mm; CI 121,4; SI 111,8; CLI 275,0; CTI 43,8–46,7; TI 66,7–68,8; PI 280,0–325; HFI 70,0–78,1.

Much lighter or paler in colour than males of *A. custodiens*, usually light-brown to pale yellowish-brown, abdomen more robust than in latter species. Chequered pattern on abdomen almost obsolete due to pubescent hairs, which are not arranged in regular rows as in *A. custodiens*. Antennae twelve-segmented as in the other two species. Scale of petiole shallowly emarginate above; clypeus not as angular in middle as in *A. custodiens*, rather arcuate. Labrum as in Figure 9C. In most specimens examined the vein m + cua in hind wing longer than half the length of cell Ia, and the stem of marginal (or radial) and cubital veins in fore wings long (Fig. 5A). In most *A. custodiens*

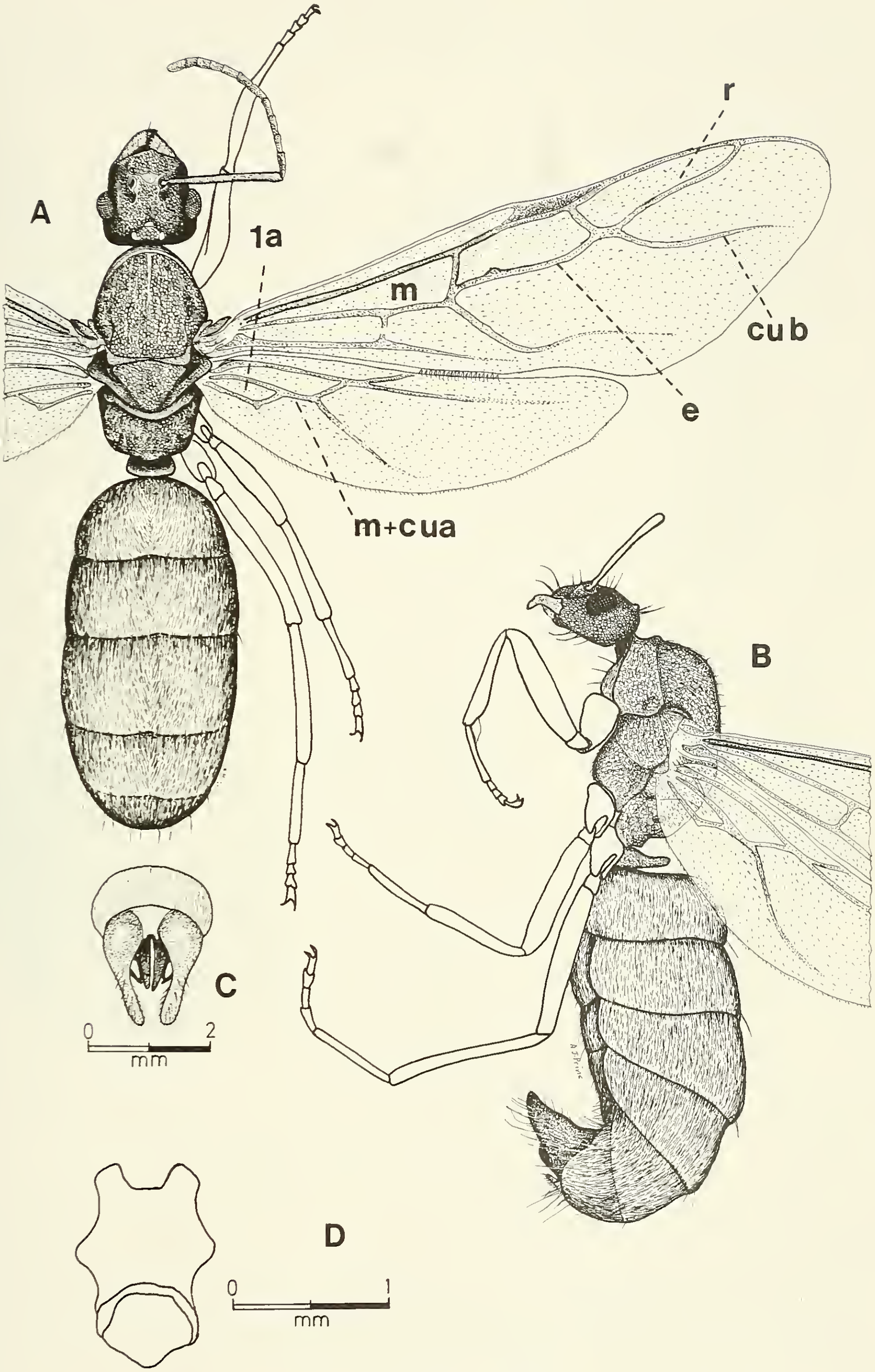


Fig. 5. *Anoplolepis nuptialis*.
A. Male, dorsal view. B. Male, left lateral view. C. Male genitalia, seen from the rear.
D. Scale of petiole seen from the rear.

males examined there is no stem, the above-mentioned veins arise directly from first cubital cell (Fig. 4A); in some specimens, however, a short stem is present.

External male reproductive organs

Males of this ant can easily be separated from those of the common pugnacious ant by the long gonostipes, which are almost triangular in lateral view and tapering towards the apices which are narrowly rounded, almost as in *A. steingroeveri*. Penis lobes much shorter than the gonostipes, but somewhat longer than appendages of volsellae in most specimens seen. In this case the digiti and cuspides are of equal length, with the former much more strongly developed than the latter. Both structures are simple, without any denticles and, as in *A. custodiens*, volsellae are somewhat globular and ventrally covered with a few fine hairs. Annular plate somewhat shorter than in *A. custodiens*, but wider, about three times wider than long; posterior emargination wider and shallower. Ventrally it is covered with fine hairs.

Its general characters and external genital organs indicate that this species is related to both the common and the black pugnacious ant, but it is apparently closer to the first. It is sometimes extremely difficult to separate the females of the two species.

Material examined

2 ♀♀ Willowmore, H. Brauns; 5 ♀♀ Du Toitskloof Pass, 15.5.74, V. B. Whitehead; 4 ♀♀ Du Toitskloof Pass, 29.5.74, A. J. Prins; 4 ♂♂ Willowmore, April 1917; 1 ♂ Boesmansberg, Feb. 1940, A. J. Hesse; 2 ♂♂ Du Toitskloof Pass 15.5.74, V. B. Whitehead; 1 ♂ Caledon, 19.3.73, A. J. Prins.

Anoplolepis steingroeveri (Forel, 1894), black pugnacious ant

Worker (Fig. 6A–B)

TL 2,9–8,0 mm; L 1,80–3,90 mm; HL 0,76–1,80 mm; ED 0,52–1,36 mm; CL 0,22–0,60 mm; SL 0,88–1,64 mm; WL 1,16–2,24 mm; MFL 0,76–1,64 mm; HFL 1,04–2,08 mm; PL 0,14–0,36 mm; CI 100,0–111,1; SI 82,0–115,8; CLI 213,3–272,7; CTI 65,5–80,4; TI 41,4–55,4; PI 142,9–188,9; HFI 89,7–92,9.

Polymorphic as in case of the common pugnacious ant and usually somewhat darker in colour, varying from reddish-brown to almost piceous-brown or blackish-brown, and also more shiny. In major workers sides of the head, seen from above, more convex than in *A. custodiens*; clypeus in lateral view also more convex medially, its anterior border, seen from above, more arcuate.

The major workers are fairly easily distinguished from those of *A. custodiens* by the absence of the chequered pattern on the abdomen due to the fact that the pubescent hairs are arranged only in one direction on each side of the median line. On the abdomen of the minors, however, there are less pubescent hairs and they are also more shiny; they are therefore sometimes confused with the workers of the black sugar-ant *Acantholepis capensis* Mayr, or even with

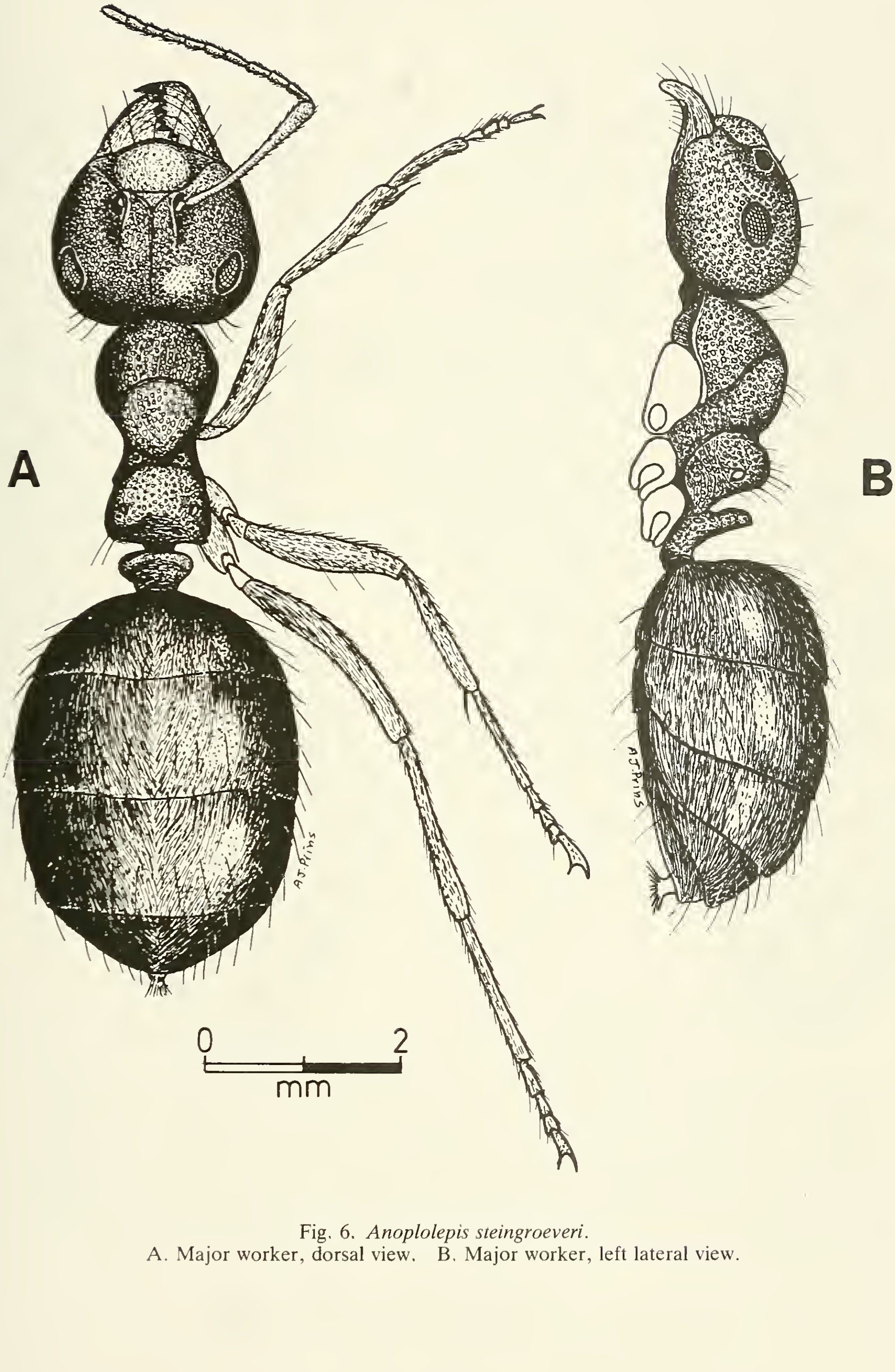


Fig. 6. *Anoplolepis steingroeveri*.
A. Major worker, dorsal view. B. Major worker, left lateral view.

those of the brown house ant, *Pheidole megacephala* Fabricius. A few pilose hairs occur on the body of all workers, as in the case of the other species.

Female (Fig. 7A–B)

Wing-span about 24,9 mm; TL 11,6–12,6 mm; L 5,2–6,4 mm; HL 1,76–1,96 mm; EK 1,56–1,70 mm; CL 0,44–0,52 mm; SL 1,6–1,7 mm; WL 3,6–4,6 mm; MFL 1,92–2,1 mm; HFL 2,36–2,6 mm; PL 0,4 mm; CI 113,6–117,4; SI 73,9–80,0; CLI 300,0–318,2; CTI 42,6–48,9; TI 58,7–63,9; PI 250,0; HFI 56,5–65,6.

Rather similar to female of *A. custodiens*, but smaller, and usually darker in colour, mostly brown to dark-brown; abdomen devoid of any chequered pattern, pubescent hairs arranged in one direction only on each side of median line. Generally somewhat more shiny than in the latter species and as in the case of the workers, the clypeus more convex, its anterior border more arcuate when seen from above.

Scale of petiole deeply emarginate above, emargination V-shaped; hind wing similar to that of *A. nuptialis*, vein m + cua long, in most specimens seen, almost as long as the cell Ia. In specimens at hand, discoidal (or subdiscoidal) vein (Fig 8A) in front wings more weakly developed than in both *A. custodiens* and *nuptialis* and usually indistinct or even obsolete.

Male (Figs 8A–C, 9E–F, 11A–B)

Wing-span about 15,7 mm; TL 6,6–6,9 mm; L 3,6 mm; HL 1,12–1,16 mm; ED 0,80–0,84 mm; CL 0,28 mm; SL 1,30–1,36 mm; WL 2,6–2,7 mm; MFL 1,80 mm; HFL 1,92 mm; PL 0,24–0,28 mm; CI 110,7–117,2; SI 100,0–104,8; CLI 300,0–328,6; CTI 42,9–43,1; TI 61,5–62,2; PI 228,6–250,0; HFI 71,1–73,1.

Smaller than male of *A. custodiens*, sombre coloured, abdomen without chequered pattern, pubescent hairs more or less arranged as in female. Scale of petiole deeply emarginate, emargination V-shaped; clypeus and wings more or less as in female. In some specimens seen the marginal and cubital veins in front wings connected by a short stem to first cubital cell, rather similar to that of *A. nuptialis*.

External male genital organs

Differ from those of both *A. custodiens* and *nuptialis* in the longer penis lobes, which are longer than volsellae and gonostipes; latter short and seen from side almost resembling those of *A. nuptialis*. Both digiti and cuspides equally developed and more or less of same length. Each digitus with fine denticles or tubercles on its external side; cuspides each with a row of fine denticles on its distal half. Volsellae in this case flattened and only slightly convex on inner side; also covered with a few fine hairs as in case of the other two species.

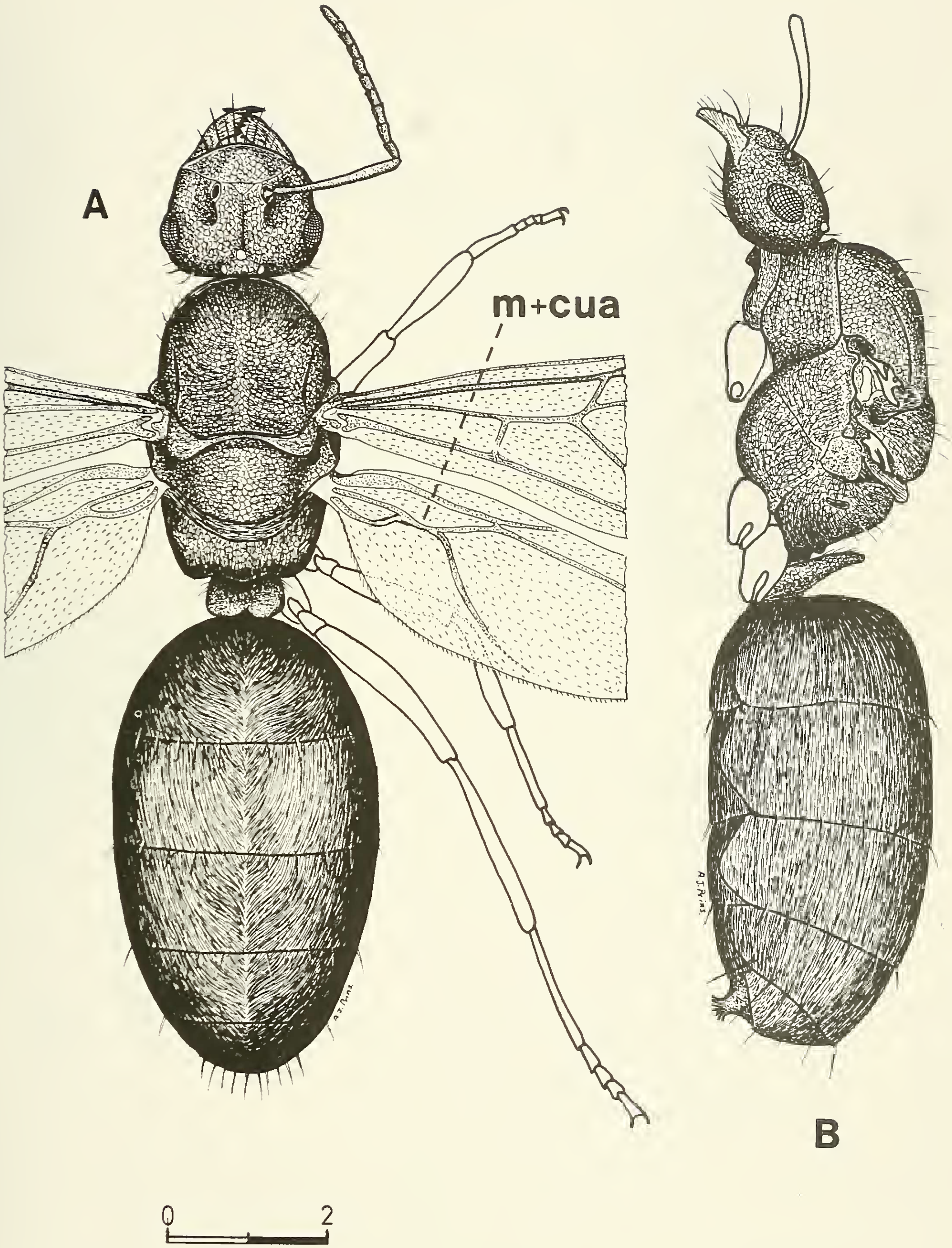


Fig. 7. *Anoplolepis steingroeveri*.
A. Female, dorsal view. B. Female, left lateral view.

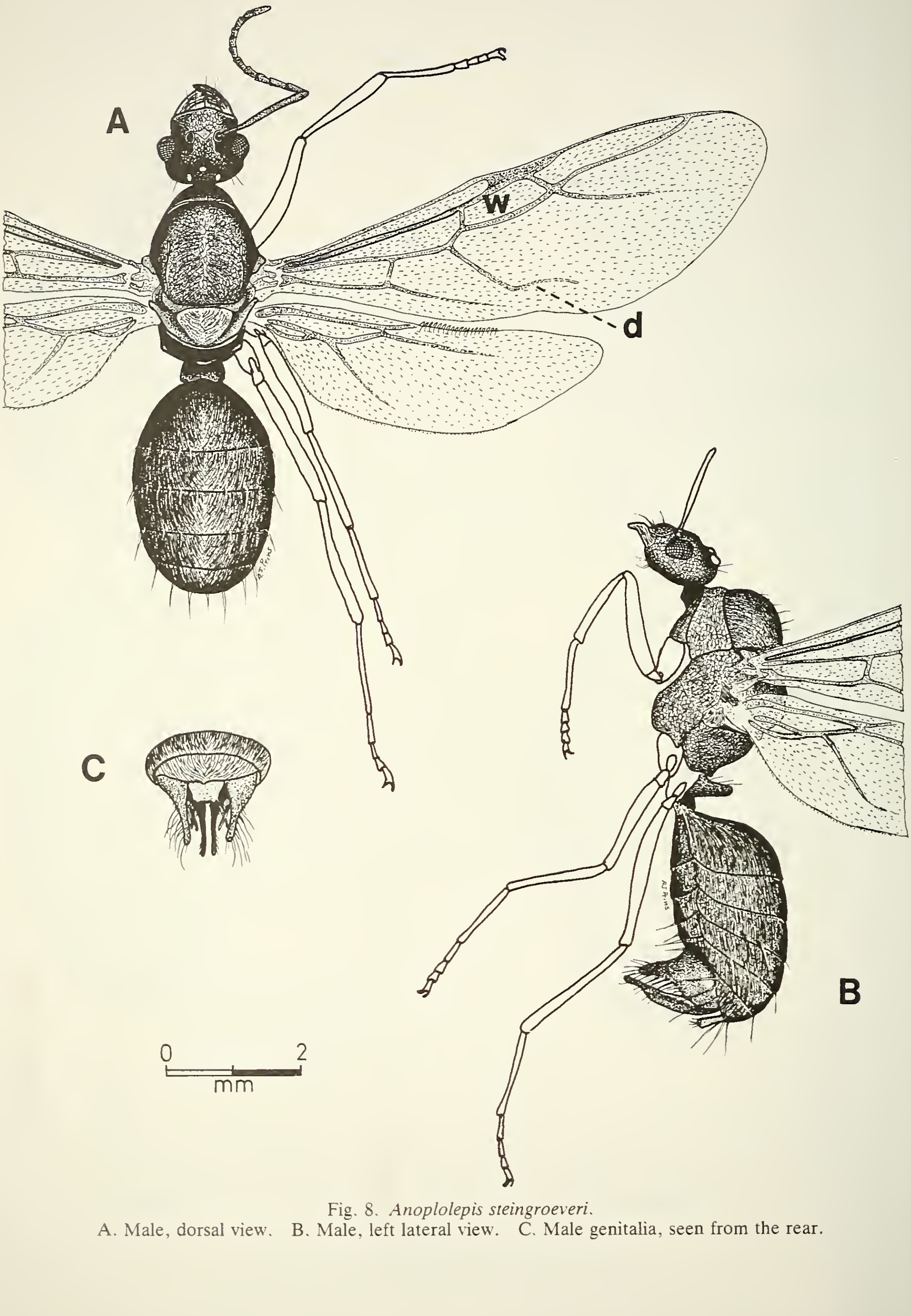


Fig. 8. *Anoplolepis steingroeveri*.
A. Male, dorsal view. B. Male, left lateral view. C. Male genitalia, seen from the rear.

Material examined

3 ♀♀ Willowmore, Dec. 1912, H. Brauns; 1 ♀ Du Toitskloof Pass, 25.1.50, A. J. Hesse; 1 ♂ Willowmore, Dec. 1912, H. Brauns; 2 ♂♂ Stanford, 20.3.72, A. J. Prins; 11 ☿☿ Cape Town, 3.4.45, A. J. Hesse; 3 ☿☿ Willowmore, Dec. 1912, H. Brauns; 25 ☿☿ Kleinmond, 23.4.60, A. J. Prins.

DISTRIBUTION OF *ANOPLOLEPIS*

Both the common and the black pugnacious ants are widely distributed throughout the Republic of South Africa as well as in South West Africa and Angola. The common pugnacious ant is also found in Zimbabwe and other central African states, but according to data collected during surveys of ants of South Africa, it appears as if the black pugnacious ant prefers the drier parts of the country. It is, therefore, the most common species in the north-west Cape and certain parts of the Little Karoo; it is particularly abundant in the Hex River valley, but it is subordinate to the common pugnacious ant in the eastern Cape and in northern Transvaal. The black pugnacious ant is also common in western Transvaal, but to date it has not been collected in eastern Transvaal and in Natal.

Alate forms of the parasitic *A. nuptialis* were observed only during the late summer and winter months in the higher parts near Willowmore, near Plettenberg Bay, in the vicinity of Caledon and Bredasdorp, and in the Du Toits Kloof Pass.

NATURAL ENEMIES OF *ANOPLOLEPIS*

Steyn (1954) gives a list of natural enemies, including ground beetles (Carabidae), tiger beetles (Cicindelidae) certain flies (Calliphoridae, e.g. *Bengalia* and possibly also *Rhina* spp. and Asilidae), and spiders as well as different species of ants.

In their effort to obtain honeydew, these ants are strongly opposed by other competitors such as the brown house-ant, *Pheidole megacephala* (Fabricius) and the related *P. tenuinodis* Mayr. In the south-eastern Cape, *P. megacephala* is replaced mainly by *P. tenuinodis* and the Argentine ant, *Iridomyrmex humilis* (Mayr).

Vertebrates also play an important role, particularly geckos, toads, and lizards. The most important natural enemies, however, apart from other ants (Forel states that the most dangerous enemies of ants are other ants), seem to be birds and, in addition to those listed by Steyn (1954), the following, feeding mainly on pugnacious ants according to crop analysis, may also be included:

Ant-eating chat—*Myrmecocichla formicivora* (Vieillot)
Black korhaan—*Eupodotis afra* (Linnaeus)
Blue korhaan—*Eupodotis caerulescens* (Vieillot)
Crowned plover—*Vanellus coronatus* (Boddaert)
Coqui francolin—*Francolinus coqui* (Smith)

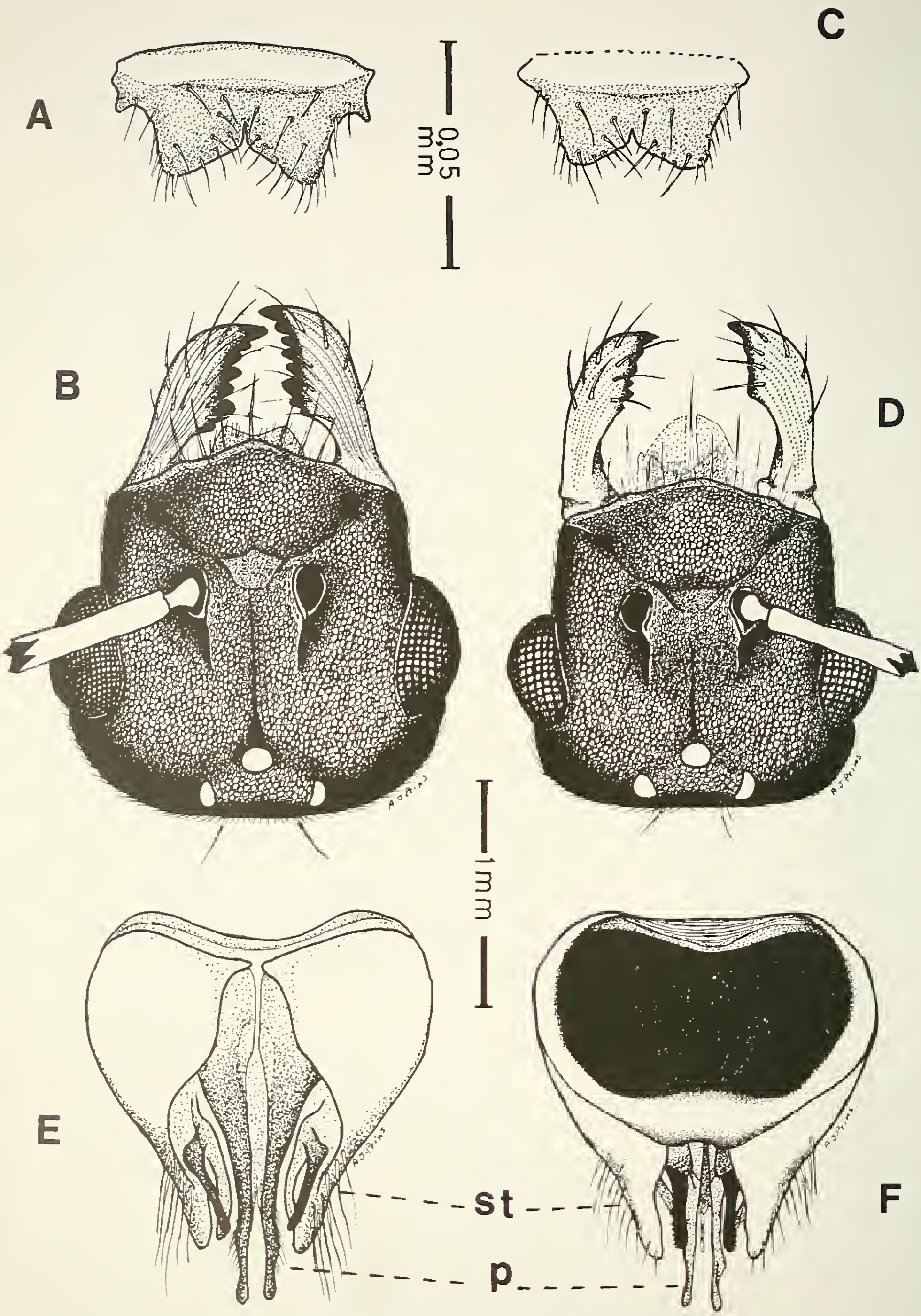


Fig. 9. A. *Anoplolepis custodiens*, labrum.
B. *Anoplolepis custodiens*, head of male from above. C. *Anoplolepis nuptialis*, labrum. D. *Anoplolepis nuptialis*, head of male from above. E. *Anoplolepis steingroeveri*, male genitalia, dorsal view. F. *Anoplolepis steingroeveri*, male genitalia, ventral view.

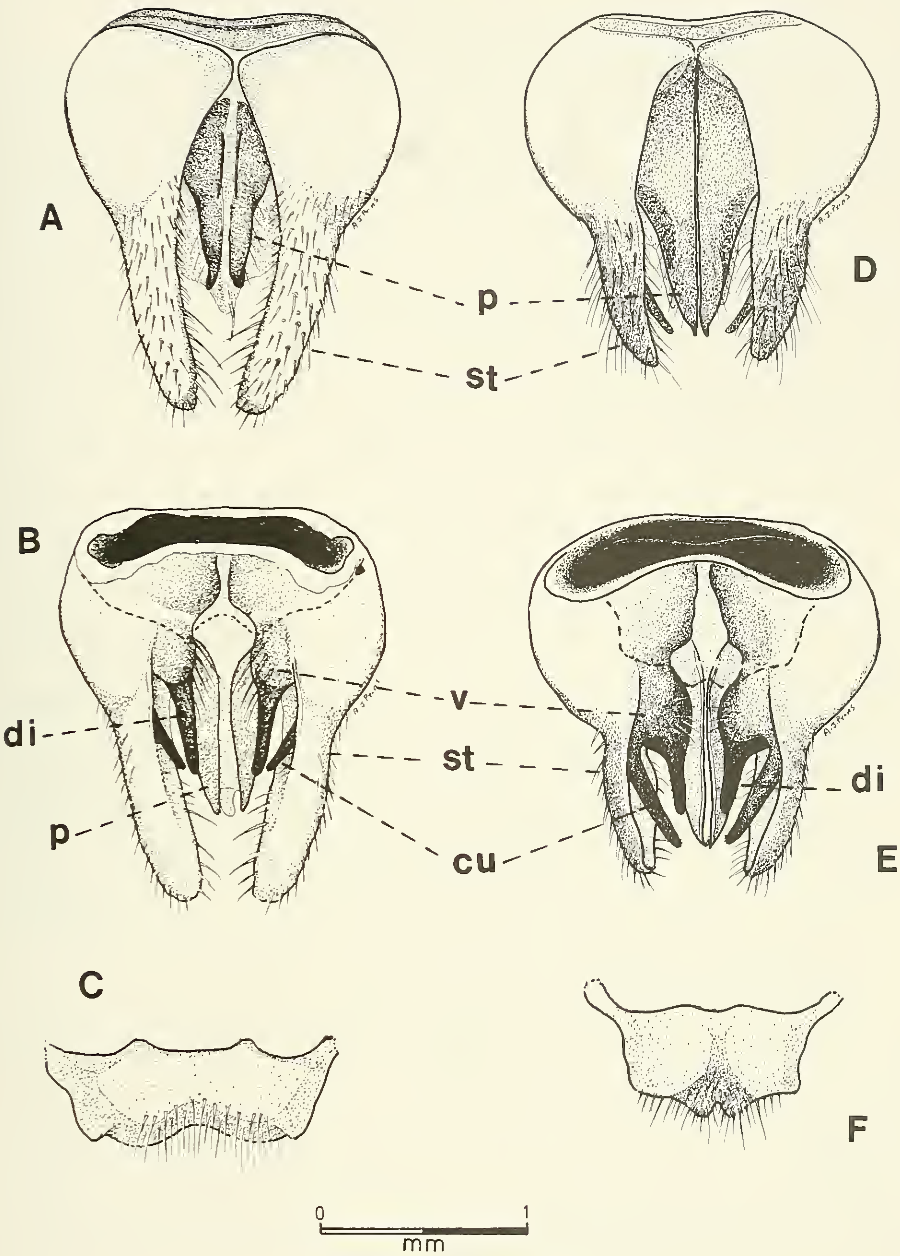


Fig. 10. Male genitalia.
A. *Anoplolepis nuptialis*, dorsal view. B. *Anoplolepis nuptialis*, ventral view. C. *Anoplolepis nuptialis*, annular plate, ventral view. D. *Anoplolepis custodiens*, dorsal view. E. *Anoplolepis custodiens*, ventral view. F. *Anoplolepis custodiens*, annular plate, ventral view.

Redwing francolin—*Francolinus levaillantii* (Valenciennes)
Swainson's francolin—*Francolinus swainsonii* (Smith)
Greater blue-eared starling—*Lamprotornis chalybaeus* (Hemprich & Ehrenburg)
Helmeted guinea-fowl—*Numida meleagris* (Linnaeus)—apparently feeds on a large variety of ants, mainly pugnacious, harvester and ponerine ants
Kori bustard—*Ardeotus kori* (Burchell)—feeds mainly on the common pugnacious ant
Red-billed hornbill—*Tokus erythrorhynchus* (Temminck)
Yellow-billed hornbill—*Tokus flavirostris* (Rüppell)—both these birds feed on a variety of insects, including almost all known ant species
Red bishop—*Euplectes orix* (Linnaeus)
Social weaver—*Philetairus socius* (Latham)
Temminck's courser—*Cursorius temminckii* Swainson
Steppe buzzard—*Buteo buteo* (Linnaeus) *vulpinus* Gloger—in contrast with the nominate subspecies, which is found in the eastern parts of the Cape, east Africa, and Ethiopia, this subspecies is a migrant from Europe and Asia and appears almost throughout South Africa during the summer; it was found to feed on the common pugnacious ant, mainly on the workers

The following birds may be regarded as myrmecophagous and usually include pugnacious ants in their diet:
Bennet's woodpecker—*Campethera bennettii* (Smith)—distributed throughout the northern parts of South Africa
Knysna woodpecker—*Campethera notata* (Lichtenstein)—distributed throughout the southern and eastern parts of South Africa
Ground woodpecker—*Geocolaptes olivaceus* (Gmelin)—widely distributed in the south-western, southern and south-eastern parts of South Africa to Transvaal
Red-throated wryneck—*Jynx ruficollis* Wagler—eastern Province to Transvaal, Botswana, and further north
Pied starling—*Spreo bicolor* (Gmelin)—widely distributed throughout the southern parts of South Africa

Various birds are known to utilize ants in their preening activities. This phenomenon, also known as anting, is, however, rare in South African birds, although it was observed by Brown & Newmann (1974) and Whyte (1981) in the case of the previously mentioned greater blue-eared starling and in the black-eyed bulbul, *Pycnonotus barbatus* (Desfountaines), and by Colahan (1981), in the Cape white eye, *Zosterops pallidus* Swainson.

The common pugnacious ant is apparently generally included in this process and it is possible that large numbers of the workers may be destroyed in this way.

KEY FOR IDENTIFICATION OF MALES AND FEMALES
OF PUGNACIOUS ANTS OF SOUTH AFRICA

1. Penis lobes of male longer than gonostipes; digiti and cuspides with denticles. Vein m + cua in hind wing of both males and females long, about as long as half the length of the cell Ia. Abdomen of both sexes (in dry specimens) without any chequered pattern .... *A. steingroeveri*
– Penis lobes shorter than gonostipes; digiti and cuspides usually without denticles. A more or less distinct chequered pattern on the abdomen of dry specimens, particularly in females; or if chequered pattern is indistinct, the vein m + cua in the hind wing of both sexes long, almost as long as half the length of the cell Ia or even longer
2. Gonostipes long, almost triangular when seen from the side, their apices narrowed or pointed; the digiti stronger developed than the cuspides; the annular plate about three times wider than long and widely and shallowly emarginate behind. Indistinct chequered pattern on abdomen of dry specimens, particularly of female; vein m + cua in the hind wing of both sexes long, about half the length of the cell Ia or even longer .... *A. nuptialis*
– Gonostipes shorter, their apices broad and round when seen from the side, digiti and cuspides equally developed; annular plate longer and narrower, about twice as wide as long; the posterior emargination deep and V-shaped. Distinct chequered pattern on abdomen of dry specimens of both sexes, and the vein m + cua in hind wing short, shorter than half the length of the cell Ia .... *A. custodiens*

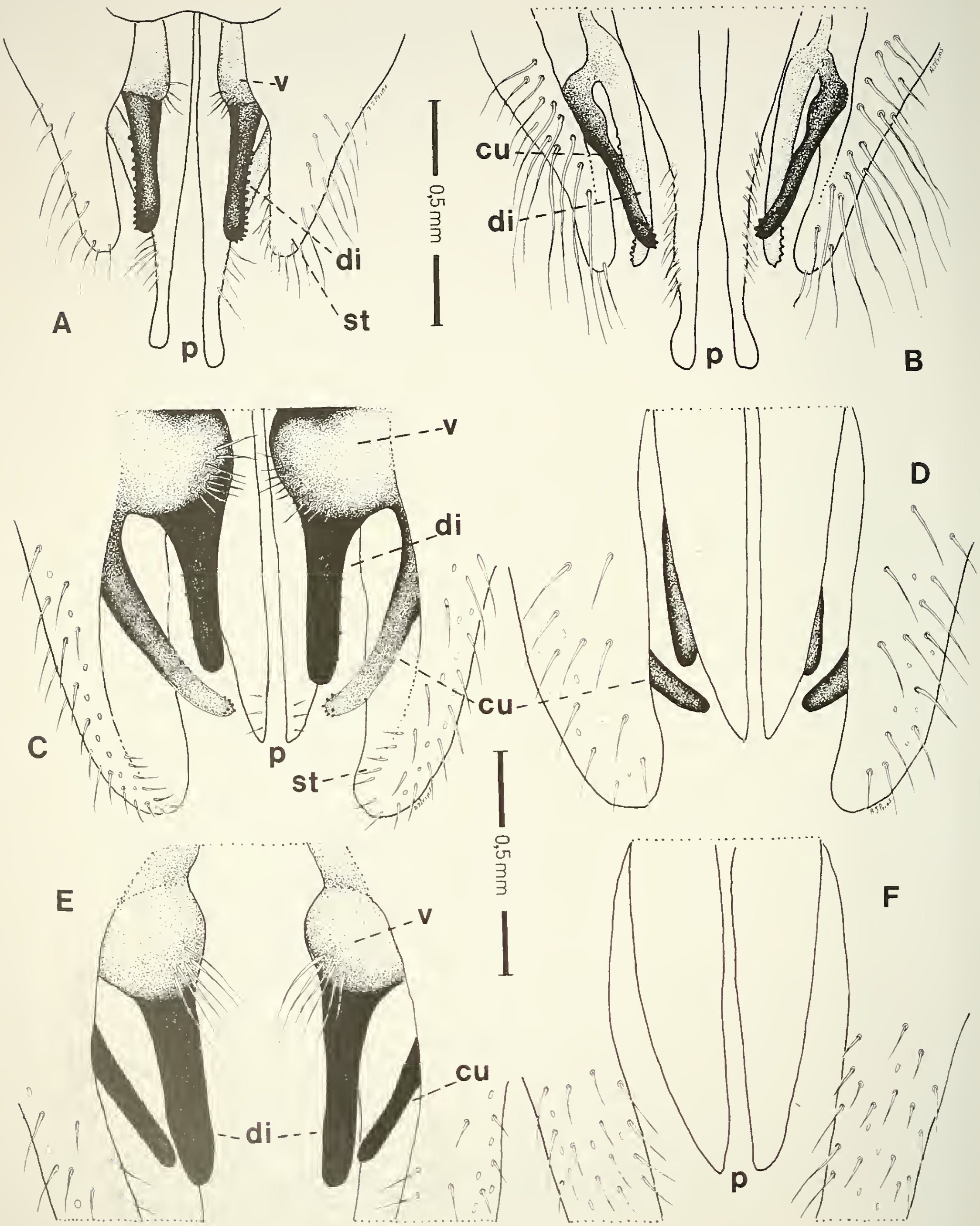
Genus *Acropyga* Roger

The South African species of this genus are small, seldom seen and therefore are not as often collected as other ant species. After various efforts, however, some specimens were found in the western Cape near Gans Bay, near Saldanha, and near Paternoster. They are hypogaeic and fairly slow-moving and apparently appear only during the late autumn and winter. Very little is known about the habits of our species, but information on Neotropical forms seems to indicate that these ants live on the honeydew produced by hemipterons, which are said to be even carried off by the females during their nuptial flight (Bünzli 1935); apparently they cause considerable damage overseas to coffee by transplanting the aphids from infested to healthy plants. It is also suggested that these ants obtain extra protein by devouring some of their trophobionts.

A small sample, which includes males and alate females, was collected at Jacobs Bay near Saldanha during the winter of 1972. Among these specimens there were some females each with a small white pseudococcid clasped between the jaws (Fig 15B), which seems to substantiate Bünzli's theory. Various specimens of this pseudococcid were collected (Fig 16A–D), including a single male with the long aedeagus at the tip of its abdomen. This mealy bug represented a new species and was described by De Lotto (1977) as *Xenococcus scorpioides*; he remarked that it is the first representative discovered in the southern hemisphere of this highly specialized group.

It is apparently common practice among the species of this genus to carry their 'cows' in their jaws, whereas ants of the genus *Hypoclinea* Mayr (Dolichoderinae), which is not represented in southern Africa, carrying them on their backs (Wilson 1971).

According to Emery (1925), *Acropyga* is divided into four subgenera, viz. *Acropyga* s.s., *Rhizomyrma* Forel (1893), *Atopodon* Forel (1912), and *Malaco-*



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myrma Emery (1922). Only the latter occurs in the Subsaharan region and is characterized by the long apical segment of the antennae, which is about as long as the four preceding segments combined, as was depicted in *A.* (*Rhizomyrma*) *palearctica* by Menozzi (1936). However, in the latter species the mandibles are elongate and exhibit a fair-sized space between them and the clypeus when they are closed, which is not the case in *Malacomyrma*.

The workers of this subgenus are yellowish in colour, monomorphic, with very small eyes, consisting of about six to twelve facets. Ocelli are absent. Head quadrate, sides almost parallel or only slightly convex, hind margin straight or somewhat concave in the middle, frontal carinae fairly wide apart, and short, antennal fossae situated close to the posterior border of the clypeus. Mandibles almost triangular, masticatory margin with six to seven small teeth, the apical one being slightly larger than the rest; when closed there is only a small space between them and the clypeus. Antennae eleven-segmented, flagella incrassate towards their apices. Labrum bilobed angularly and deeply emarginate in the middle in the specimens examined (Fig. 13C). Gotwald (1969) depicts the labrum of the Brazilian *Acropyga* as weakly emarginate. Labial palpi three-segmented. Clypeus strongly convex in the middle, but not carinate.

Truncus fairly robust, the promeso- and meta-epinotal sutures well developed, the mesometanotal suture in some specimens distinct in others almost obsolete. Dorsum of epinotum short, merging into the declivity in a wide angle, unarmed. Petiole squamiform, the scale inclined forwards. Legs moderately long.

The median seta on the anterior border of the clypeus is characteristic of this genus. It occupies a lower position than the other clypeal setae and reminds one of a trigger hair for setting off the snap action of the mandibles when in the act of catching prey, or it may even act as a tactile organ, perhaps for detecting their honeydew producing agents.

Only one species, *A. arnoldi*, in which the workers have a conspicuous metanotum, four-segmented maxillary palpi and larger eyes (0,04–0,05 mm in length, and consisting of about twelve facets) was originally described from the southern African subregion by Santschi (1926). Two years later he described *A. rhodesiana*. In the latter species the workers have a reduced metanotum, and five-segmented maxillary palpi. A third species, *A. silvestrii*, was described by Emery (1915) from Eritrea and it was apparently taken for granted at that time that the maxillary palpi are one- to two-segmented (Emery 1925; Gotwald 1969). Emery also neglected to mention the number of segments in the maxillary palpi of *silvestrii*.

The small collection, made in July 1972 at Jacobs Bay on the west coast (previously mentioned), contained workers with small eyes (about 0,02 mm

Fig. 11. Male genitalia, cuspides and digiti.
A. *Anoplolepis steingroeveri*, ventral view. B. *Anoplolepis steingroeveri*, dorsal view. C. *Anoplolepis custodiens*, ventral view. D. *Anoplolepis custodiens*, dorsal view. E. *Anoplolepis nuptialis*, ventral view. F. *Anoplolepis nuptialis*, dorsal view.

long and consisting of about six facets), a distinct metanotum, and five-segmented maxillary palpi. In this case the males and alate females have four-segmented and five-segmented palpi respectively. A second collection made about a year later at Gans Bay on the south coast produced workers very similar to those found at Jacobs Bay, also having small eyes and five-segmented palpi, but the mesometanotal suture is almost obsolete. During the winter of 1974, however, collections made at Paternoster, about 12 km north of Jacobs Bay, revealed workers of both types (some with small eyes, obsolete mesometanotal suture and four-segmented palpi and some with larger eyes, an almost distinct mesometanotal suture, and five-segmented palpi).

It seems reasonable under these circumstances to assume that most (if not all) Subsaharan forms have four to five segmented maxillary palpi (the author has unfortunately not seen *A. silvestrii*). In specimens with four-segmented palpi, the apical segment is about as long as the two preceding ones; in the five-segmented forms, the apical segment is shorter, only about as long as the preceding one. Unfortunately no males of either the Zimbabwe or Paternoster forms are as yet known, but on account of the above evidence it is apparent that *A. arnoldi* is a variable species and *A. rhodesiana* should, therefore, be considered a synonym.

Acropyga arnoldi Santschi, 1926

Acropyga arnoldi Santschi, 1926: 245
Acropyga rhodesiana Santschi, 1928: 211 syn. nov.

Worker (Fig. 12A–C, 15A)

TL 2,40 mm; LI 1,32 mm; HL 0,60–0,62 mm; ED 0,42–0,44 mm; CL 0,14 mm; SL 0,40–046 mm; WL 0,68–0,76 mm; MFL 0,38–0,40 mm; HFL 0,44–0,55 mm; PL 0,10–0,12 mm; CI 90,0–90,3; SI 74,1–82,1; CLI 271,4–300,0 CTI 81,6–88,2; TI 52,9–55,3; PI 150,0–180,0; HFI 64,7–65,8.

Brownish-yellow to yellowish, shiny all over, whole body finely punctured with piliferous punctures; pubescence moderately long, yellowish and fairly abundant all over, especially on head and abdomen. Pilosity long, yellowish, evident only on mandibles, clypeus, apical margins of abdominal segments, and on scale.

Head almost quadrate about one-ninth longer than wide, sides almost straight, hind margin very feebly emarginate, or almost straight. Clypeus with anterior margin arcuate in middle, somewhat sinuate on each side, and with an angle in between each sinuation and the median area. Frontal area clearly defined. Eyes small, consisting of about twelve facets, and placed well before middle of sides of head. Scape about four-sevenths the length of flagellum and about two-thirds as long as the head, reaching hind margin; second to fourth flagellar segments about of equal length and shorter than fifth.

Truncus slightly longer than head, pro-mesonotal and meta-epinotal sutures distinct, mesometanotal suture either distinct or obsolete. Metanotum

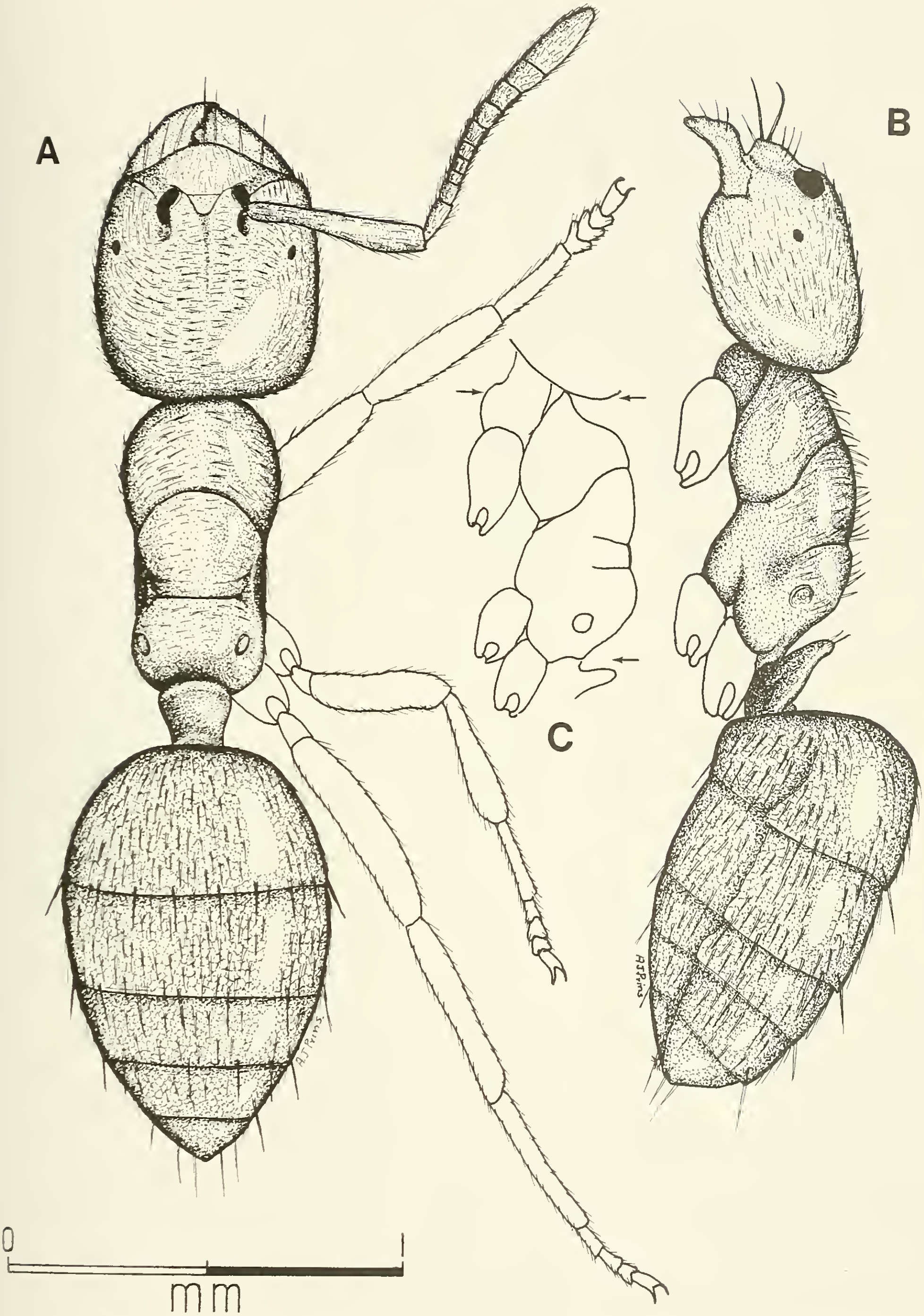

Fig. 12. *Acropyga arnoldi*.
A. Dorsal view of specimen described from Zimbabwe. B. Left lateral view of specimen described from Zimbabwe. C. Left lateral view of truncus of specimen described from Durban.

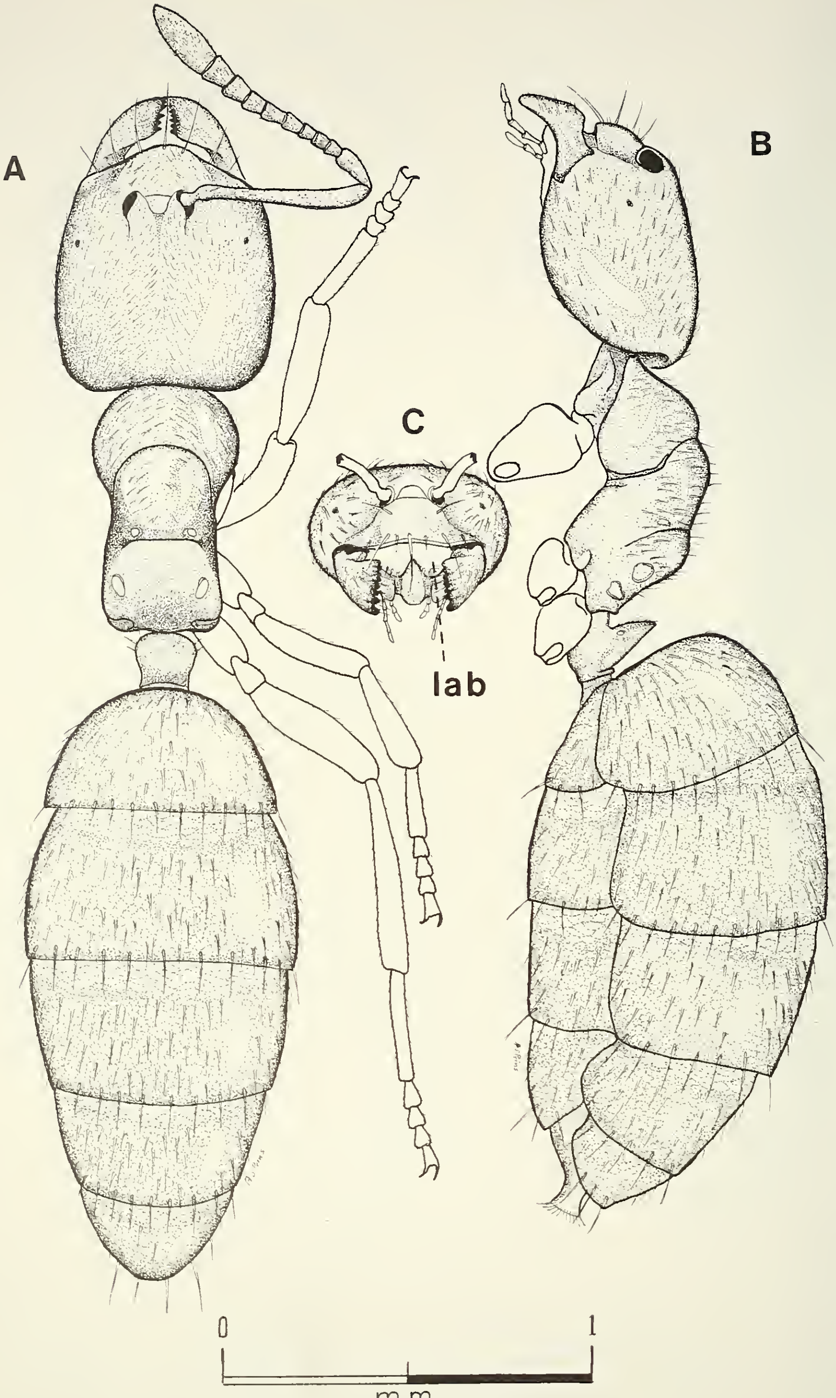

Fig. 13. *Acropyga arnoldi*.
A. Dorsal view. B. Left lateral view. C. Head seen from the front, showing the labrum.

short, shorter than either meso- or epinotum; latter seen from the side convex and somewhat higher than promesonotum; epinotal declivity longer than dorsum, almost flat, its sides rounded. Scale of petiole wider than long, nearly as high as wide, rounded dorsally and, seen from behind, wider above than below. Abdomen nearly as long as the head and truncus together or slightly longer, rounded at base. Legs moderately long.

Workers of this species collected near Gans Bay (Fig. 13A–C) are very similar to those described above, but the scape of the antennae is somewhat longer and may extend beyond the hind margin of the head by the width of the second segment of the flagellum. The truncus in the specimens seen is very slightly shorter, and in profile the mesonotum is higher than the pro- or epinotum. The ranges of measurements of twenty specimens are as follows:

TL 2,40–2,96 mm; L 1,26–1,40 mm; HL 0,60–0,64 mm; ED 0,40–0,42 mm; CL 0,12–0,13 mm; SL 0,46–0,48 mm; WL 0,60–0,66 mm; MFL 0,38–0,42 mm; HFL 0,48–0,52 mm; PL 0,11–0,12 mm; CI 87,1–93,3; SI 79,3–85,5; CLI 307,7–333,3; CTI 94,1–103,3; TI 55,9–65,0; PI 150–163,4; HFI 73,5–83,3.

These ants are also very similar to those collected at Jacobs Bay, but differ from them by the absence of the mesometanotal suture. They also resemble the specimens collected at Paternoster, but in the latter case in specimens with five-segmented maxillary palpi, the eyes are larger and a distinct mesometanotal suture is present. The mesonotum is also higher than the pro- or epinotum; the ranges of the various measurements are:

L 1,30–1,46 mm; HL 0,62–0,68 mm; ED 0,46–0,50 mm; CL 0,15–0,17 mm; SL 0,48–0,54 mm; WL 0,60–0,70 mm; MFL 0,40–0,46 mm; HFL 0,48–0,58 mm; PL 0,12–0,14 mm; CI 93,8–100,0; SI 78,1–84,4; CLI 270,6–306,7; CTI 97,1–103,3; TI 62,9–70,9; PI 142,9–166,7; HFI 76,2–82,9.

Female (Figs 14A–B, 15B, E)

TL 3,5–4,0 mm; L 1,80–2,08 mm; HL 0,70–0,76 mm; ED 0,56 mm; CL 0,16 mm; SL 0,5–0,56 mm; WL 1,16–1,22 mm; MFL 0,56 mm; HFL 0,64 mm; PL 0,12 mm; CI 106,5–108,8; SI 72,7–72,9; CLI 343,8–363; CTI 60,6–62,3; TI 68,9–75,8; PI 200,00; HFI 52,4–55,2.

Brown to piceous-brown in colour, legs paler, antennae yellowish, mandibles castaneous. Fairly shiny all over. Finely punctured with piliferous punctures, giving whole integument a superficially and finely reticulate texture. Pubescence yellowish, moderately long, fairly abundant, especially on abdomen. Erect pilosity yellowish, sparse, usually present on mandibles, clypeus, scutellum, scale of petiole and apical borders of abdominal segments.

Head very slightly longer than wide, quadrate, sides very slightly convex, hind margin almost straight or slightly emarginate. Compound eyes black, moderately large, occupying nearly one-quarter of the length of the head, and placed in front of middle of sides. Ocelli large. Frontal area clearly demarcated. Scapes of eleven-segmented antennae about five-sevenths the length of the

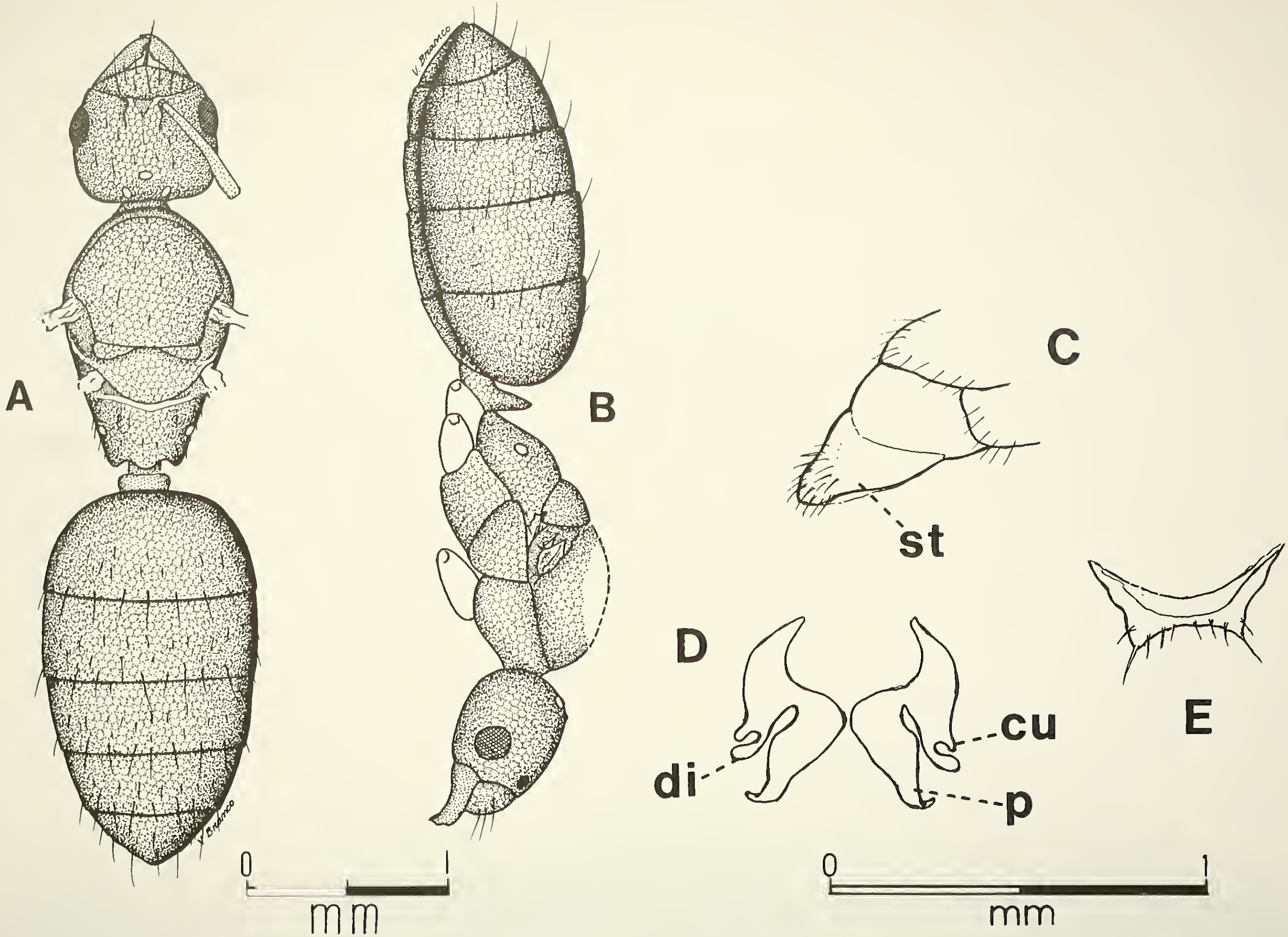

Fig. 14. *Acropyga arnoldi*.
A. Female dorsal view. B. Female, right lateral view. C. Male genitalia, right lateral view. D. Cuspides, digiti and penis, dorsal view. E. Annular plate, ventral view.

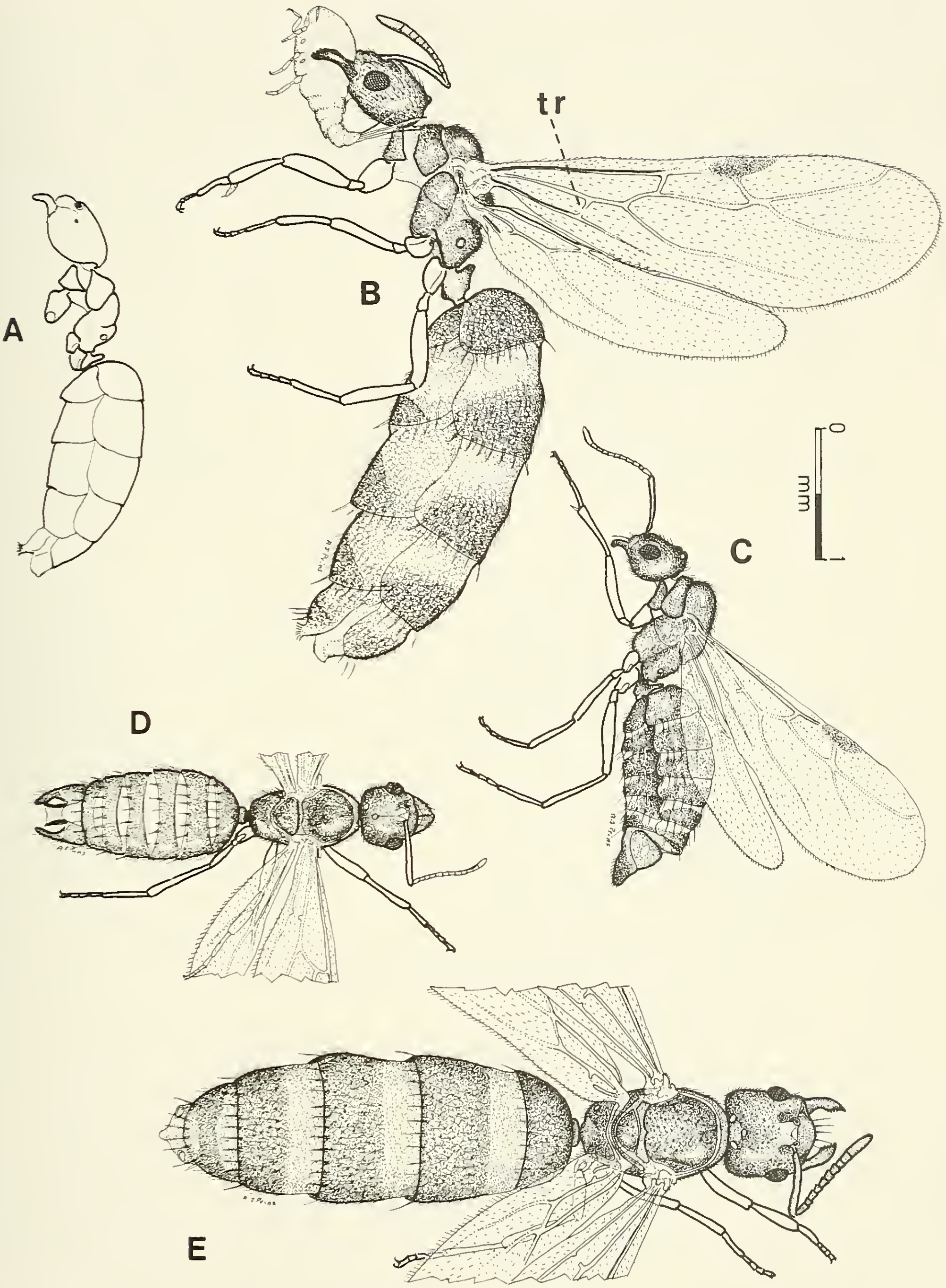

Fig. 15. *Acropyga arnoldi*.
A. Worker, left lateral view. B. Female with coccid between jaws, left lateral view. C. Male, left lateral view. D. Male dorsal view. E. Female, dorsal view.

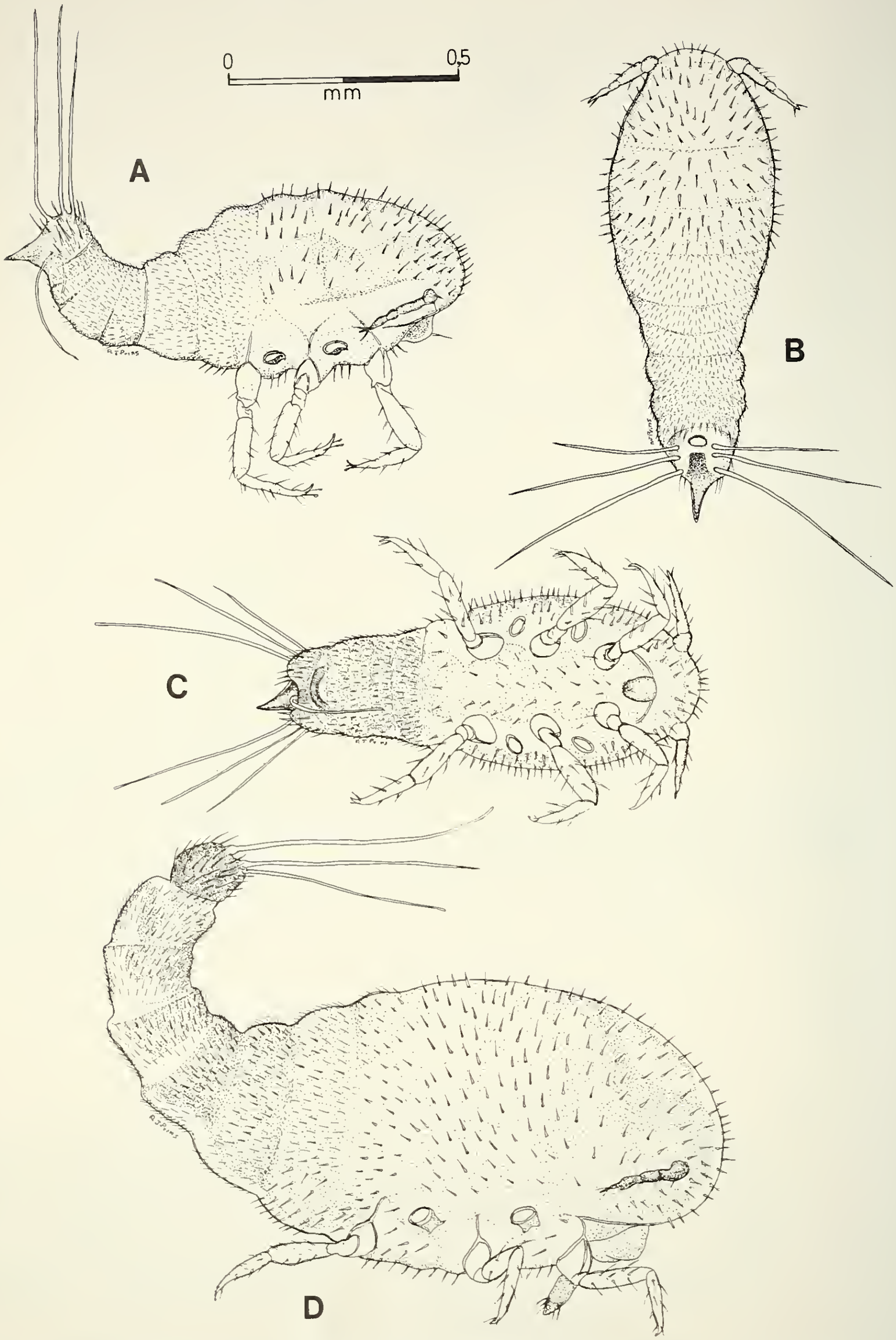

Fig. 16. *Xenococcus scorpioides*.
A. Male, right lateral view. B. Male, dorsal view. C. Male, ventral view. D. Female, right lateral view.

head and extending behind hind margin of head by about the width of first flagellar segment. Apical segment of flagellum about as long as three preceding ones taken together. Clypeus as in worker.

Truncus about one-quarter or slightly more longer than wide, the sides somewhat convex, parapsidal furrows clearly defined, scale of petiole almost as in worker, dorsum slightly emarginate. Legs moderately long. Wings hyaline, stigma fairly large and slightly darker, venation similar to that of *Anoplolepis*, but with large break in transverso-median cross vein (Fig. 15B). Abdomen about as long as head and truncus taken together, rounded at base.

Male (Figs 14C–E, 15C–D)

TL 2,20 mm; L 1,24 mm; HL 0,43 mm; ED 0,34 mm; CL 0,06 mm; SL 0,48 mm; WL 0.8 mm; MFL 0,56 mm; HFL 0,58 mm; PL 0,08 mm; CI 113,04; SI 92,3; CLI 533,3; CTI 53,6; TI 75,0; PI 187,5; HFI 72,5.

Piceous-brown, shiny all over, eyes black. Legs and flagella paler in colour than body. Pubescence moderately long, adpressed and whitish-yellow. A few pilose hairs present, particularly on head and posterior margins of abdominal segments. Sculpture similar to that of female.

Head slightly wider than long, sides and posterior margin convex. Clypeus rather convex from side to side, also very convex in lateral view, forming a deep notch between it and junction of frontal carinae; its anterior margin almost straight. Eyes bulging, large, almost as long as half the length of the sides of the head. Ocelli large. Scape of twelve-segmented antennae extending behind hind margin of head by about one-third of its length. Apical segment of flagellum about as long as three preceding segments taken together. Legs moderately long. Maxillary palpi four-segmented, apical segment longer than preceding one and somewhat tapering towards apex and undivided in specimen seen. Labial palpi three-segmented. Mandibles with five to six small teeth, apical ones longer.

Truncus longer than wide, somewhat narrower than head, anterior margin of scutellum indicated by thin black line. Scale of petiole similar to that of female, thinner above than below, very slightly emarginate in middle of dorsal edge.

External genital organs

Gonostipes longer than volsellae and penis almost triangular, tapering towards apices, the latter rounded. Penis lobes broad and also triangular, about of same length as volsellae; almost spoon-shaped digiti somewhat longer than short cuspides, which are rounded. Annular plate small, almost trapezoidal, widely and shallowly emarginate behind, lateral angles acute, each with long seta; there are also some setae on ventral plate.

Material examined

Holotype ♀, Durban, 29.8.18, C. P. Merwe; another ♀ Jacobs Bay, 20.7.72, A. J. Prins; ♂, Jacobs Bay 20.7.72, A.J. Prins; syntype ☿☿, Durban, 29.8.18, C. P. Merwe; syntype ☿☿, Bulawayo, 9.11.24; other ☿☿ Jacobs Bay, 20.7.72, A. J. Prins; Gans Bay 3.3.73, A. J. Prins; Paternoster, 19.6.74, V. B. Whitehead.

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